

THE AMERICAN JUNIPERS OF THE SECTION SABINA  
(JUNIPERUS, CUPRESSACEAE)--A CENTURY LATER

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Engelmann (1977) published the first account of the taxa of Juniperus (Cupressaceae), section Sabina of North America a century ago. Fourteen taxa were recognized at that time. Reevaluation of the sabinoid junipers of North America, as a whole, has not been made since then. In the intervening period, several regional studies concerning the taxonomy of the taxa have been made (Mexico: Martinez, 1944, 1946, 1953, 1963; Mexico and Guatemala: Zanoni and Adams, 1975a, 1976; United States: Sargent, 1896, 1902; W. United States: Vasek, 1966, Vasek and Scora, 1967). Numerous studies have been made concerning populational variation and hybridization (Adams 1972, 1975a, 1975b; Adams and Turner, 1970; Fassett, 1944a, 1944b, 1945a, 1945b, 1945c; Flake, Von Rudloff, and Turner, 1969; Hall, 1952a, 1952b, 1955; Hall and Carr, 1964, 1968; Hall, McCormick, and Fogg, 1962; Schurtz, 1973; Van Haverbeke, 1968).

The literature concerning the North American sabinoid junipers has been examined intensively as a consequence of the current work on the Mexican and Guatemalan junipers (Zanoni and Adams, 1975a and 1976). This preparation of the extensive synonymy was prompted to clarify the confused state of knowledge of these taxa, to incorporate the latest published research, to include our (T.A. Zanoni and R.P. Adams) observations of the taxa, to comment on the problematic taxa, to establish the distributions, and to cite other relevant literature relating to these taxa.

The recognition of "variety" is preferred over that of "subspecies" in this treatment to maintain uniformity in subspecific hierarchal ranking (the usage of "variety" has predominated in the genus Juniperus) and lessen the nomenclatural baggage that would accumulate by changes in hierarchal ranking. Dates of publication of earlier literature have been checked against Stafleu (1967).

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Synonymy of cultivars of Juniperus has not been included in this paper because of the inherent problems in determining the origins of cultivars, and tracing the nomenclatural history in horticultural literature.

Holotypes or lectotypes are cited for taxa when they have been found. If the search for a type yielded no type, or if recent literature indicated that types are not extant for certain authorities, the author of this paper indicates this in the citations of types. Citation of types of the taxa named by Martínez (1944, 1946) may differ from those listed in his publications. Martínez marked specimens with the word "tipo" at MEXU, and it is clear that these specimens were the types.

Juniperus L., Sp. Pl. 1038. 1753; Sabina P. Miller, Gard. Dict. Abr. ed. 4. 1754; Sabinia Lewis, Univ. Texas Bull. 22:43. 1915. (misspelled); Thuiaecarpus Trautvetter, Pl. Imag. Fl. Russ. 11. 1844; Arceuthos Antoine & Kotschy, Oesterr. Bot. Wochenbl. 249. 1854. Type species: Juniperus communis L.

Several authors (beginning with Antoine, 1857) acknowledged the genus Sabina Miller. Examination of the text in the Gardeners Dictionary (Miller, 1754) revealed that the distinction between Juniperus and Sabina is the same as used section Oxycedrus and section Sabina of Juniperus sensu lato.

Miller (1754) describes Juniperus as "The leaves are long, narrow, and prickly; the Male Flowers are in some Species produced at remote Distances from the Fruit on the same Tree; but in the other Species they are produced on different Trees from the Fruit: the Fruit is a soft pulpy Berry, containing three Seeds in each." Sabina is described as "It hath compact, rigid, and prickly ever-green Leaves: the Fruit is small, small spherical, and warted; and the whole Plant has a very rank strong Smell." Leaf and seed number characteristics are the differences between Miller's genera. The inclusion of "3. Juniperus virginiana. H.L. Folio ubique juniperino. Boerh. Ind. the Cedar of Virginia," "4. Juniperus virginiana, foliis inferioribus juniperinus, superioribus sabinam, vel cypressum referentibus. Boerh. Ind. Red Virginian Cedar," and "5. Juniperus Bermudiana. H.L. The Cedar of Bermudas" in Juniperus illustrates Miller's limited knowledge of the different leaf types found in Juniperus. The juvenile leaves of J. virginiana L. and J. bermudiana L. were considered to be equivalent to the mature (adult) leaves of J. communis L. These species (J. bermudiana and J. virginiana) should have been placed in Sabina Miller; also, the sabinoid scale-shaped leaf and the number of seeds per cone do not fit Miller's description of Juniperus.

The circumscription of the genus Juniperus by Linnaeus (1753) is preferred over Miller's Juniperus and Sabina, allowing for considerable diversity in vegetative and reproductive characters. The

variation (see review by Lemoine-Sebastian, 1967a, and 1967b) can be recognized at the sectional level, as accepted by most authors (Komarov, 1934, and Gaussen, 1967, use subgenera, but no formal recognition of these taxa as subgenera has been made). Section Oxycedrus Spach (Ann. Sci. Nat. ser. 2, 16:288. 1841) accommodates Juniperus sensu Miller; Section Sabina Spach (Ann. Sci. Nat. ser. 2, 16:291. 1841) accommodates Sabina sensu Miller.

Juniperus drupacea Labill. has been placed in the monotypic section Caryocedrus Endlicher (Syn. Conif. 8, 1847.) or alternatively in the monotypic genus Arcenthos Antoine & Kotschy. Gaussen (1967) admitted that when recognizing sections Oxycedrus and Sabina in Juniperus, one does not have much argument for exclusion of J. drupacea from Juniperus.

Current work (Zanoni and Adams, 1975a, 1976) does not substantiate the divisions of the sabinoid junipers into the "sections" and "series" of Gaussen (1968) or the subsections of Martinez (1946). Recognition of subsections of section Sabina is not made here.

Generic typification of Juniperus has been confused in the literature. Florin (1956) accepted Pilger's (1926) "typische Art" as the first designation of generic lectotypes. However, the earliest typification of Juniperus appears to be that by Britton (1908) in "North American Trees," an often neglected source for typification of arborescent genera, where it is clearly stated "...the type species being Juniperus communis Linnaeus." (p. 107). The type species is the same as designated by Pilger (1926).

1. Juniperus ashei Buchholz, Bot. Gaz. 9:329. 1930. Type: United States: Arkansas: Stone County: Sylamore, W. W. Ashe 22520 (Lectotype: NCU!, selected by Hall, 1954).
  - J. occidentalis var. Texana Vasey, Rep. [U.S.] Commiss. Agric. 1875:185. 1876. Type: Not designated by Vasey. nomen nudum.
  - J. occidentalis var. ? conjungens Engelmann, Trans. Acad. Sci. St. Louis 3:590. 1877. Type: United States: Texas: (locality unknown), Berlandier 671 (Holotype: MO; Isotype: US!).
  - J. sabinooides (H.B.K.) Nees sensu Sargent, Silva N. Amer. 10:91. 1897; non J. sabinooides (H.B.K.) Nees, Linnaea 19: 706. 1847; Sabina sabinooides (H.B.K.) J.K. Small, Fl. Southeastern U.S. 33, 1326. 1903.

This species had been frequently called J. mexicana Sprengel by various authors (e.g. Hopkins, 1938). The name J. mexicana had been erroneously applied to J. ashei and many other sw. United

States and Mexican species. Usage of J. sabinoides for this taxon was based upon improper application of a name that is currently a synonym of a form of J. monticola. Hall and Carr (1964) reported hybridization with J. virginiana; Hall, McCormick, and Fogg (1962) reported hybridization with J. pinchotii. See Adams and Turner (1970) and Flake, Von Rudloff, and Turner (1969) about hybridization in J. ashei.

Distribution: Arkansas, Missouri, Oklahoma, Texas, U.S.A.; and Coahuila, Mexico. Maps: Little (1971), Maps 21-W, 21-E; Adams (1975a), Fig. 2. Selected References: Adams (1975a); Adams and Turner (1970); Hall (1954).

2. Juniperus blancoi Martinez, Anal. Inst. Biol. Mexico 17:73, 74. 1946. Type: Mexico: Durango: Arroyo de Penuelas in El Salto, C.E. Blanco A-500 (Holotype: MEXU!).

Distribution: States of Durango, Sonora, and nw. Mexico, Mexico. Map: Zanoní and Adams (1978).

3. Juniperus californica Carriere, Rev. Hort. ser. IV, 3:352. 1854. Type: United States: California: (locality?), M. Boursier s.n. (Holotype: P); Sabina californica (Carr.) Antoine, Cuppress.--Gatt. 52. 1857.

J. pyriformis Lindley, Gard. Chron. (23 June 1855): 420. 1855. Type: United States: California: San Bernardino Mountains, W. Lobb.

J. cerrosianus Kellogg, Proc. Calif. Acad. Sci. 2:37. 1859. Type: Mexico: Baja California: Cedros Island, Veatch s.n. (Holotype: A!); J. cedrosiana Kellogg, Hesperian 4:3,4. 1860. Type: Mexico: Baja California: Cedros Island, Veatch s.n. (Holotype: probably same as for J. cerrosianus, see Zanoní and Adams, 1973).

J. occidentalis W. J. Hooker sensu Parlatores in DC, Prodrum 16(2):489, 490. 1868.

J. californica var. siskiyouensis L. F. Henderson, from Oregon is J. occidentalis.

Distribution: California, s. Nevada, w. Arizona, U.S.A.; Baja California, Mexico. Maps: Little (1971), Map 20-W; Vasek (1966), Fig. 5; Zanoní and Adams (1973), Fig. 1. Selected References: Vasek (1966); Vasek and Scora (1967); Zanoní and Adams (1973).

4. Juniperus comitana Martinez, Anal. Inst. Biol. Mexico 15:12,13. 1944. Type: Mexico: Chiapas: 12 km. S. of Comitán, Martinez, 6700 (Holotype: MEXU!).

Distribution: Departamentos of Baja Verapaz, Huehuetenango, and Zacapa, Guatemala; Chiapas, Mexico. Map: Zanoni and Adams (1978).

5. Juniperus deppeana Steudel

- 5a. Juniperus deppeana Steudel var. deppeana, Nom. Bot. ed. 2:835. 1841; J. mexicana Schlecht. & Chamisso, Linnaea 5:77, 1830. Type: Mexico: Vera Cruz: Llanos de Perote, Schiede in 1828 (Isotype: MO!); non J. mexicana Sprengel, Syst. Veg. 3:909. 1826; J. foetida & thurifera Spach., Ann. Sci. Nat. ser. 2. 16:298. 1841; Sabina mexicana (Schlecht. & Chamisso) Antoine, Cupress. -Gatt. 38. 1857.

J. gigantea Roetzl, Cat. Graines Conif. Mexico 8. 1857. Type: Mexico: Tlaxcala: (locality?), Roetzl (Holotype: location not known). Sabina gigantea (Roetzl) Antoine, Cupress.--Gatt. 36. 1857.

The earliest available epithet for this taxon is J. deppeana (see Little, 1948, for nomenclatural discussion). J. mexicana Schlecht. can not be applied to this taxon because the combination was used earlier by Sprengel for plants now referred to J. monticola f. compacta Martinez.

Distribution: Texas, U.S.A.; Coahuila, s. in Sierra Madre Oriental to Puebla, Mexico. Map: Zanoni and Adams (1978).

- 5b. Juniperus deppeana var. deppeana f. sperryi (Correll) R. P. Adams, Brittonia 25:289. 1973; J. deppeana var. Sperryi Correll, Wrightia 3:188. 1966. Type: United States: Texas: Jeff Davis County: Dry Canyon of Davis Mountains, about 8 mi. from Sproul Ranch Headquarters. Sperry T870 (Type: GH; Isotype: US!).

Distribution: Texas, U.S.A.; Sonora, Mexico. Map: Zanoni and Adams (1978). Selected Reference: Adams (1973).

- 5c. Juniperus deppeana var. pachyphlaea (J. Torrey) Martinez, Anal. Inst. Biol. Mexico 17:53. 1946; J. pachyphlaea J. Torrey, U.S. Rep. Survey Miss.--Pacific 4(5):142. 1857. Type: United States: New Mexico: Zuni Mountains, Bigelow in 1853 (Holotype: NY!); J. pachyphloea J. Torrey in Ives, Rep. Colo. River 4:28. 1861. Sabina pachyphlaea (J. Torrey) Antoine, Cupress.--Gatt. 39. 1857. Sabina pachyphloea (J. Torrey) A. A. Heller, Muhlenbergia 5:120. 1909. Sabina pachyphloea (J. Torrey) I.M. Lewis. Univ. Texas Bull. 22:43. 1915.

J. pachyderma Sitgreaves, Rep. Exped. Zuni Colo. River. 35. 1854; J. plochyderma in Sitgreaves, Rep. Exped. Zuni Colo. River plate 16. 1854; (Sitgreaves used J. pachyderma; how-

ever Torrey did not use the name in the botanical description. J. plochyderma is a printer's error); Sabina plochyderma Antoine, Cupress.,--Gatt. 40. 1857.

This variety has not been studied recently. Investigations relating it to the other varieties of J. deppeana are needed.

Distribution: Arizona and New Mexico, U.S.A.; Sonora, Mexico.

- 5d. Juniperus deppeana var. patoniana (Martinez) T. A. Zanoni, Biochem. Syst. & Ecology 4:152. 1976: J. patoniana Martinez, Anal. Inst. Biol. Mexico 17:62, 63. 1946. Type: Mexico: Durango: El Salto, C.E. Blanco 6710 (Holotype: MEXU!).

J. patoniana f. obscura Martinez, Anal. Inst. Biol. Mexico 17: 68. 1946. Type: Mexico: Durango: El Salto: C. E. Blanco A-510 (Holotype: MEXU!); J. deppeana var. obscura (Martinez) Gausson, Trav. Lab. Forest. Toulouse Tome II, Sect. I, Vol. 1, partie II 2, fasc. 10. 150, 152. 1968.

Distribution: Sierra Madre Occidental of Durango, Mexico. Map: Zanoni and Adams (1978).

- 5e. Juniperus deppeana var. robusta Martinez, Anal. Inst. Biol. Mexico 17:47. 1946. Type: Mexico: Durango: Pueblo Nuevo, Estevez A502 (Holotype: MEXU!).

Distribution: Sierra Madre Occidental from Chihuahua and Sonora, s. to Jalisco and Zacatecas, Mexico. Map: Zanoni and Adams (1978).

- 5f. Juniperus deppeana var. zacatecensis Martinez, Anal. Inst. Biol. Mexico 17:57, 58. 1946. Type: Mexico: Zacatecas: 10 km. W. of Sombrerete, Martinez A503 (Holotype: MEXU!); J. zacatecensis (Martinez) Gausson, Trav. Lab. Forest. Toulouse Tome II, Sect. I, Vol. 1, partie II 2, fasc. 10. 151. 1968.

Distribution: In w. Zacatecas and adjacent Durango, Mexico. Map: Zanoni and Adams (1977).

6. Juniperus durangensis Martinez, Anal. Inst. Biol. Mexico 17:94, 95. 1946. Type: Mexico: Durango: Puerto de Santo Domingo, 30 km. from El Salto, Martinez 7015 (Holotype: MEXU!).

Distribution: Sonora, Chihuahua, Durango, Zacatecas, Aguascalientes and Jalisco, Mexico. Map: Zanoni and Adams (1978).

7. Juniperus erythrocarpa Cory, Rhodora 38:186. 1936. Type: United States: Texas: Brewster County: Laguna in Chisos Mts., Cory 7642 (Holotype: A!).

- J. erythrocarpa var. coahuilensis Martínez, Anal. Inst. Biol. Mexico 17:115, 116. 1946. Type: Mexico: Coahuila: Sierra de los Hechiceros, Johnston and Muller 1290 (Holotype: MEXU!; Isotypes: GH!, NA!, TENN!, TEX!), J. coahuilensis (Martínez) Gausson, Trav. Lab. Forest. Toulouse Tome II, Sect. I, Vol. 1, partie II 2, fasc. 10. 154. 1968.
- J. texensis Van Melle, Phytologia 4:26. 1952. Type: United States: Brewster County: Big Bend National Park, Brenckle 51019 (Holotype: NY!; Isotype: A).

See J. pinchotii for comments.

Distribution: Chihuahua, Coahuila, Durango, Nuevo Leon, Sonora, Tamaulipas, Zacatecas, Mexico; s. Arizona, s. New Mexico, and w. Texas, U.S.A. Map: Zanoni and Adams (1978). Selected References: Adams (1975b); Zanoni and Adams (1975a, 1976, 1978).

8. Juniperus flaccida Schlecht.

- 8a. Juniperus flaccida Schlecht. var. flaccida, Linnaea 12:495. 1838. Types: Mexico: Hidalgo: Atonilco el Chico, Schiede in 1830; Mexico: Hidalgo: Regla, Ehrenberg s.n. (Holotypes: location not known, probably lost or destroyed; Isotype: MO 2085919!, U.S. 12053431!); J. foetida  $\theta$  flaccida (Schlecht.) Spach, Ann. Sci. Nat., ser. 2, 16:300. 1841; Sabina flaccida (Schlecht.) Antoine, Cupress.--Gatt. 37. 1857; Sabina flaccida (Schlecht.) A. A. Heller, Muhlenbergia 5:120. 1909; Sabina flaccida (Schlecht.) I. M. Lewis, Univ. Texas Bull. 22:43, 1915.
- J. gracilis Endl., Syn. Conif. 31. 1847; J. gracilis Hort. in Roezl., Cat. Graines Conif. Mexico. 8. 1857. Type: not designated.
- J. gigantea Roezl in part, Cat. Graines Conif. Mexico. 8. 1857. Type: Mexico: Mexico: Tenancingo at 7-8000 feet, Roezl s.n. (Holotype: location not known); Sabina gigantea (Roezl) Antoine in part, Cupress.--Gatt. 36. 1857; J. flaccida var. gigantea (Roezl) Gausson, Trav. Lab. Forest. Toulouse Tome II, Sect. I, Vol. 1, partie II 2, fasc. 10. 117. 1968.

Distribution: Texas, U.S.A.; Sonora, Chihuahua, Coahuila and Tamaulipas, s. to Jalisco and Oaxaca, Mexico. Map: Zanoni and Adams, (1978).

- 8b. Juniperus flaccida var. poblana Martínez, Anal. Inst. Biol. Mexico 17:31. 1946. Type: Mexico: Puebla: Amozoc at 2300 m., Martínez 507 (Holotype: MEXU!).

Cupressus thurifera H.B.K., Nova Gen. et Sp. Pl. 2:3. 1817.  
Type: Mexico: Guerrero: prope Tasco et Tehuilotepec,  
Humboldt and Bonpland 3956 (Holotype: P; as fragments  
 and photograph!); Chamaecyparis thurifera Endl., Syn.  
 Conif. 62. 1847.

Distribution: Jalisco, e. to Oaxaca, Mexico. Map: Zanoní and  
 Adams (1978).

9. Juniperus gamboana Martínez, Anal. Inst. Biol. Mexico 15:7,8.  
 1944. Type: Mexico: Chiapas: near Teopisca, Martínez  
6701 (Holotype: MEXU!).

Distribution: Huehuetenango, Guatemala; Chiapas, Mexico. Map:  
 Zanoní and Adams (1978).

10. Juniperus horizontalis Moench, Meth. Pl. 699. 1794. Type:  
 no longer extant (see Stafleu, 1967); Sabina vulgaris  
 Antoine in part, Cupress.--Gatt. 58. 1857; Sabina hor-  
izontalis (Moench) Rydberg, Bull. Torrey Bot. Club 39:100.  
 1912.

J. prostrata Persoon, Syn. Pl. 2:632. 1807. Type: Canada:  
A. Michaux; J. sabina var. prostrata (Persoon) Loudon,  
 Arb. Frut. Brit. 4:2499. 1838; J. virginiana var. pros-  
trata (Persoon) Torrey, Fl. New York 2:235. 1843. Sabina  
prostrata (Persoon) Antoine, Cupress.--Gatt. 57. 1857.

J. sabina  $\beta$  procumbens Pursh, Fl. Amer. Sept. 647. 1814  
 (based upon specimens of Michaux.)

J. repens Nuttall, Gen. N. Amer. Pl. 2:245. 1818.

J. hudsonica Forbes, Pinet. Woburn. 208. 1829.

J. foetida  $\gamma$  multicaulis Spach in part, Ann. Sci. Nat. ser. 2,  
 16:295. 1841.

J. sabina B. humilis Carriere in part, Traite Gen. Conif. 35.  
 1855.

J. horizontalis f. lobata O. W. Knight, Rhodora 9:202. 1907.  
Type: United States: Maine: Otter Cliffs on Mount  
 Desert Island, O. W. Knight 5311.

Distribution: Boreal, from Alaska, e. to Newfoundland, s. to Mon-  
 tana, Wyoming, Nebraska, Iowa, Illinois, Michigan, New York, and  
 Connecticut. Maps: Little (1971) Maps 22.1-N, 22.1-W, 22.1-E;  
 Viereck and Little (1975), Map 14.

11. Juniperus jaliscana Martínez, Anal. Inst. Biol. Mexico 17:69.  
 1946. Type: Mexico: Jalisco: Cuale, González 7002



(Holotype: MEXU!).

Distribution: Pueblo Nuevo in Durango and Cuale in Jalisco, Mexico.  
Map: Zanoni and Adams (1978).

12. Juniperus monosperma (Engelmann) Sargent.

12a. Juniperus monosperma (Engelmann) Sargent var. monosperma,  
Silva N. Amer. 10:38. 1896; J. occidentalis var.  $\beta$  monosperma  
Engelmann, Trans. Acad. Sci. St. Louis 3:590. 1877.  
Type: United States: Colorado: Fremont County: Canon  
City, (collector ?) (Holotype: MO); Sabina monosperma  
(Engelmann) Rydberg, Bull. Torrey Bot. Club 32:598. 1904;  
J. mexicana var. monosperma (Engelmann) Cory, Rhodora 38:  
183. 1936.

J. occidentalis var. (c) gymnocarpa Lemmon, Handb. West-Amer.  
Cone-Bearers ed. 3, 80. 1895. Type: none designated; J.  
monosperma f. gymnocarpa (Lemmon) Rehder, J. Arnold Arbor.  
7:239. 1926; J. gymnocarpa (Lemmon) Cory in part, Rhodora  
38:184. 1936.

Florin (1933) and Morton (1941) reviewed the occurrence of  
gymnocarpy (seeds exerted from the cone) in Juniperus. Our field  
observations indicate that gymnocarpy occurs in cones of any species  
of Juniperus in North America. Insect larvae infest the immature  
cones, causing abnormal development of seeds and cones, resulting  
in the gymnocarpous condition. Usually, the seed will not contain  
a fully-developed endosperm and embryo. Cory (1936), in changing  
the status of J. occidentalis var. gymnocarpa Lemmon, included sev-  
eral species in his J. gymnocarpa. Lemmon (1895) stated that he  
observed the plants on the Sandia Mountains, near Albuquerque, New  
Mexico. These plants are referable to J. monosperma. Cory (1936)  
altered Lemmon's description to include plants from sw. Texas, New  
Mexico, Arizona, Utah, Nevada, Colorado, and Mexico. Subsequently,  
he inadvertently included plants that are now recognized as J. ery-  
throcarpa, J. pinchotii, and possibly J. osteosperma in his J. gym-  
nocarpa. Cory did not recognize the teratological nature of gymno-  
carpy in his specimens, and assumed it to be a valid characteristic.

J. monosperma var. monosperma has been reported from s. Arizona  
(s. of the Mogollon Rim) and in n. Mexico (Sonora, Chihuahua, Dur-  
ango, Coahuila, Zacatecas, Nuevo Leon, San Luis Potosi, and Tamaulipas).  
Our field observations and chemotaxonomic investigations (Adams, 1972;  
Adams, 1975b; Zanoni and Adams, 1975a and 1976) have shown that the  
junipers are J. erythrocarpa, J. pinchotii, and J. monosperma  
var. gracilis. We have not seen herbarium specimens nor  
observed live plants from Mexico that are J. monosperma var. mono-  
sperma.

Distribution: s. central Colorado, into n. Arizona, New Mexico,

nw. Oklahoma, and w. and n. Texas, U.S.A.

- 12b. Juniperus monosperma var. gracilis Martinez, Anal. Inst. Biol. Mexico 17:111, 112. 1946. Type: Mexico: San Luis Potosi: Hacienda de Angostura, Pringle 3771 (Holotype: not at MEXU; Isotypes: VT, ARIZ!, F!, GH!, MO!, NY!, UC!).

Distribution: Sierra Madre Oriental foothills from Coahuila, s. to Hidalgo, Mexico. Map: Zanoni and Adams (1978).

13. Juniperus monticola Martinez

- 13a. Juniperus monticola Martinez f. monticola, Anal. Inst. Biol. Mexico 17:79. 1946; J. tetragona Schlecht., Linnaea 12: 495. 1838, nom. nov. Type: Mexico: Hidalgo: Mineral del Monte, Ehrenberg s.n. (Holotype: not found, probably lost or destroyed; Isotype: here designated, MO!); non J. tetragona Moench, Meth. Pl. 699, 1794; Sabina tetragona (Schlecht.) Antoine, Cupress.--Gatt. 40. 1857.

Distribution: Jalisco, Michoacan, Guerrero, Mexico, Puebla, Mexico. Map: Zanoni and Adams (1978).

- 13b. Juniperus monticola f. compacta Martinez, Anal. Inst. Biol. Mexico 17:87. 1946; Cupressus sabinoides H.B.K., Nova Gen. et Sp. Pl. 2:3, 4. 1817. Type: Mexico: Vera Cruz: Cofre de Perote, Humboldt and Bonplant s.n. (Holotype: P); J. mexicana Sprengel, Syst. Veg. 3:909. 1826; non J. mexicana Schlecht. & Chamisso, Linnaea 5:77. 1830; J. sabinoides (H.B.K.) Nees, Linnaea 19:706. 1847; J. sabinoides Humboldt [erroneously attributed] in Lindley and Gordon, J. Hort. Soc. 5:202. 1850; non J. sabinoides Griseb., Spicil. Fl. Rumel. 2:352. 1844. [1845 or 1846 according to Staf-leu, 1967].

The nomenclatural history of this taxon was reviewed by Hall (1954). Sprengel's use of J. mexicana is illegitimate because the specific epithet from Cupressus sabinoides should have been used. J. mexicana Schlecht. and Chamisso and J. sabinoides (H.B.K.) Nees are homonyms of J. mexicana Spengel and J. sabinoides Griseb., respectively. Martinez' decision to base J. monticola upon J. tetragona Schlecht. (an illegitimate epithet) and the recognition of a J. monticola f. compacta based upon Cupressus sabinoides require the usage of J. monticola f. monticola and J. monticola f. compacta as legitimate epithets for these two taxa.

Distribution: Jalisco, Mexico, Nuevo Leon, Puebla, San Luis Potosi, Tamaulipas, Vera Cruz, Mexico. Map: Zanoni and Adams (1978).

- 13c. Juniperus monticola f. orizabensis Martinez, Anal. Inst. Biol. Mexico 17:91. 1946. Type: Mexico: Vera Cruz: Pico de

Orizaba, I. de B. 162 (Holotype: location not known, not found; Lectotype: here designated, Martinez 8001, MEXU!).

Distribution: Nuevo Leon, Puebla, Vera Cruz, Mexico. Map: Zanoni and Adams (1978).

14. Juniperus occidentalis W. J. Hooker

14a. Juniperus occidentalis W. J. Hooker var. occidentalis, Fl. Bor.-Amer. 2:166. 1838. Type: United States: Washington on the Columbia River, E of junction with Spokane River [see Douglas' journal], D. Douglas in April, 1826 (Holotype: K; fragment at US!); Sabina occidentalis (W. J. Hooker) Antoine, Cupress.--Gatt. 64. 1857; Sabina occidentalis (W. J. Hooker) A. A. Heller, Muhlenbergia 1:47. 1904.

J. californica var. siskiyouensis L. F. Henderson, Rhodora 33: 203. 1931. Type: United States: Oregon: Jackson County "Summit of the Siskiyou Mountains, near highway", L. F. Henderson 12483 (Holotype: ORE).

J. occidentalis f. robinsoni O. V. Matthew, J. Forestry 43: 756. 1945. Type: United States: Oregon: Gilliam County: 1.5 mi. W of Lonerock, Matthews on 20 February 1945 (Holotype: Peck Herbarium of Willamette Univ., Salem, Oregon, on loan to OSC).

J. excelsa sensu Pursh had been considered a synonym of J. occidentalis; Sargent (1902, page 94 footnote 2) examined the specimen collected by M. Lewis, and decided that J. scopulorum was collected. Reexamination of the same specimen (as fragments and photograph) confirmed Sargent's decision. (See synonymy under J. scopulorum).

Distribution: In forests and sagebrush from Lassen County, California, to nw. Nevada and e. Oregon, to sw. Washington, U.S.A. (Vasek 1966). Map: Vasek (1966), Fig. 5.

14b. Juniperus occidentalis var. australis (Vasek) A. Holmgren and N. Holmgren in Conquist, Holmgren, Holmgren, and Reveal, Intermountain Fl. 1:239. 1972; J. occidentalis ssp. australis Vasek, Brittonia 18:352. 1966. Type: United States: California: San Bernardino County: 0.2 mi. N of North Shore Highway on Polique Canyon Road to Holcombe Valley, Vasek 610929-38 (Holotype: RSA).

Distribution: In forests and pinyon woodland from Lassen County, California, s. to San Bernardino Mountain, and w. Nevada, U.S.A. (Vasek, 1966; Little, 1971). Map: Vasek (1966), Fig. 5. Selected References: Fowells (1965); Griffin and Critchfield (1972); Vasek

(1966); Vasek and Scora (1967).

15. Juniperus osteosperma (J. Torrey) Little, Leaf1. Western Bot. 5:125. 1948; J. tetragona var. osteosperma J. Torrey, U.S. Rpt. Surv. Miss.-Pacific 4(5):141, 142. 1857. Type: United States: Arizona: Coconino County: "Near Bill Williams' Mtn." Bigelow in January, 1854 (Lectotype: designated by Little (1948), NY!) and United States: California: San Bernardino County: "on hills fifty miles west of the Colorado of California" [probably in Providence Mtns. (Little, 1948)], Bigelow in March, 1857 (Lectotype: designated by Little (1948), US!); Sabina osteosperma (J. Torrey) Antoine, Cupress.-Gatt. 51. 1857.
- J. Knightii A. Nelson, Bot. Gaz. 25:198. 1898. Type: United States: Wyoming: Sweetwater County: "Point of Rocks," A. Nelson 3096 (Holotype: RM); J. monosperma var. Knightii (A. Nelson) Lemmon, Handb. West-American Cone-bearers ed. 4, 114. 1900; Sabina knightii (A. Nelson) Rydberg, Bull. Torrey Bot. Club 32:598. 1904.
- J. megalocarpa Sudworth, Forestry & Irrig. 13:308. 1907. Type: United States: New Mexico: Catron County: midway between Alma and Frisco, about 3 mi. above "Widow Kelley's Ranch" on the San Francisco River, W. R. Mattoon in 1906 (Holotype: US); Sabina megalocarpa (Sudworth) Cockerell, Muhlenbergia 3:143. 1908; J. utahensis var. megalocarpa (Sudworth) Sargent, Bot. Gaz. 67:208. 1919; J. utahensis megalocarpa Sudworth, U.S.D.A. Misc. Circ. 92: 41. 1927.
- J. Californicus var. Utahense Vasey, Cat. Forest Trees U.S. 37. 1876, also Rpt. [U.S.] Comm. Agric. 1875: 185. 1876. Type: Not designated by Vasey. nomen subnudum; J. Californica var. Utahensis Engelmann, Trans. St. Louis Acad. Sci. 3:588. 1877. Type: Not designated by Engelmann; J. occidentalis var. utahensis (Engelmann) Kent in Veitch's Man Conif. 289. 1881; J. utahensis (Engelmann). Lemmon, California State Board Forestry Bienn. Rpt. 3:183. 1890; Sabina utahensis (Engelmann) Rydberg, Bull. Torrey Bot. Club 32:598. 1904.
- J. utahensis var. cosnino Lemmon, Sierra Club Bull. 4:122. 1902. Type: United States: Arizona: Coconino County: "along and near Cosnino Canon, ten miles east of Flagstaff, Arizona, south and near the base of the San Francisco Mountains," J. G. Lemmon and Wife on 25 November 1892; J. Cosnino Lemmon, Sierra Club Bull. 4:123. 1902.

Little (1948) reviewed the synonymy of J. occidentalis, therefore repetition of the comments need not be made here. However, see J. andina in section "Indeterminable Epithets" in this present paper.

Distribution: Mainly in the Great Basin region, from extreme s. Montana and s. Idaho, into e. and s. California, Nevada, Utah, w. Colorado, n. Arizona, and w. New Mexico, U.S.A. Maps: Little (1971), Map 27-W; Griffin and Critchfield (1972), Map 33; Vasek (1966) Fig. 5. Selected References: Little (1948); Vasek (1966); Vasek and Scora (1967); Wight and Fisser (1968).

16. Juniperus pinchotii Sudworth, Forest. & Irrig. 10:204. 1905. Type: United States: Texas: Randall County: Paloduro Canyon, Clothier in May, 1905 (Holotype: U.S. 1583659!); Sabina pinchotii (Sudworth) I. M. Lewis, Univ. Texas Bull. 22:44. 1915; J. monosperma var. pinchotii (Sudworth) Van Melle, Phytologia 4:29. 1952.

J. erythrocarpa was frequently combined under J. pinchotii; however, evidence (Adams, 1975b; Zanoni and Adams, 1975a, 1976) has indicated that the old usage of J. pinchotii includes two taxa--J. erythrocarpa and J. pinchotii.

Distribution: sw. Oklahoma, w. Texas, se. New Mexico, U.S.A.; Coahuila, Mexico. Map: Adams (1975b), Fig. 1.; Zanoni and Adams (1978). Selected References: Adams (1972); Adams, (1975b); Smith, Wright, Schuster (1975); Zanoni and Adams (1975a, 1976, 1978).

17. Juniperus saltillensis M. T. Hall, Fieldiana, Bot. 34:45. 1971. Type: Mexico: Coahuila: 18 mi. S of Saltillo on Mexico Highway 57, Hall 66305-1 (Holotype: F!).

Distribution: e. Chihuahua, Coahuila, Nuevo Leon, and Zacatecas, Mexico. Map: Zanoni and Adams (1978). Selected Reference: Hall (1971).

18. Juniperus scopulorum Sargent, Gard. & Forest 10:420. 1897. Type: not designated by Sargent; Lectotype: here designated, Wyoming: Yellowstone National Park: Mammoth Hot Springs, C. S. Sargent on July 8, 1906, (Lectotype: A!), nomen provisorum; J. scopulorum Sargent, Silva N. Amer. 14; 93. 1902; J. virginiana var. scopulorum (Sargent) Lemmon, Handb. West-Amer. Cone-Bearers ed. 4, 114. 1900. Sabina scopulorum (Sargent) Rydberg, Bull. Torrey Bot. Club 32: 598. 1904. Sabina scopulorum (Sargent) I.W. Lewis, Univ. Texas Bull. 22:46. 1915.

- J. excelsa sensu Pursh, Fl. Amer. Sept. 2:647. 1814. Type: United States: "on the banks of the waters of the Rocky-mountains," M. Lewis 58 (Holotype: PH, as photograph! as fragments!); J. sabina var. excelsa Raf., Med. Fl. & Bot. U.S. 2:14. 1830; J. foetida  $\xi$  excelsa (Bieberstein) Spach in part, Ann. Sci. Nat. ser. 2, 16:297. 1841. non J. excelsa Bieberstein, Fl. Taur. -Cauc. 2:245. 1808.

- J. occidentalis var.  $\alpha$  pleiosperma Engelmann, Trans. Acad. Sci. St. Louis 3:590. 1877. (based on J. excelsa sensu Pursh and J. andina Nuttall).
- J. virginiana var. montana Vasey, Rep. [U.S.] Commiss. Agric. 1875: 184. 1876. Type: not designated by Vasey. nomen nudum.
- J. scopulorum var. patens Fassett, Bull. Torrey Bot. Club 72: 46. 1945. Type: United States: Wyoming: Big Horn County: between the Big Horn River and the Big Horn Mountains, E of Lovell, Fassett 22062 (Holotype: WIS); X J. fassettii Boivin, Naturaliste Canad. 93:372. 1966.
- J. scopulorum var. columnaris Fassett, Bull. Torrey Bot. Club 72:482. 1945. Type: United States: North Dakota: Slope County: bottom of deep gully, edge of pine region, Amidon, O. A. Stevens 504 (Holotype: NDA). J. scopulorum f. columnaris (Fassett) Rehder, Bibliog. Cult. Trees & Shrubs 63. 1949.

Numerous studies (Fassett, 1944a, 1944b, 1945a, 1945c; Van Haverbeke, 1968; Schurtz, 1973) have reported hybridization of J. scopulorum with J. horizontalis based upon morphological evidence. R. P. Adams is currently investigating geographic variation in J. scopulorum using morphological and chemical data; results of this work should prove useful in examining the possibilities of past introgression by J. horizontalis and J. virginiana.

J. excelsa sensu Pursh was frequently placed in synonymy under J. occidentalis. The Lewis #58 specimen (PH) collected 2 October, 1804 along the Missouri River in McLean or Mercer County, North Dakota (Cutright, 1969; Thwaites, 1959) is clearly J. scopulorum. Sargent (1902) was the first to discover the true identity of the Lewis specimen; his observations went unheeded for 75 years.

Distribution: In w. N. America, from British Columbia, Alberta, Montana and North Dakota, s. to Arizona, e. Sonora, nw. Chihuahua, Texas, and nw. Coahuila (Little, 1971; Zanoni and Adams, 1975b).

Maps: Fowells (1967) p. 217; Little (1971), Maps 30-W, 30-N; Zanoni and Adams (1975b).

19. Juniperus silicicola (J.K. Small) Bailey, Cultiv. Conif. N. Amer. 197. 1933. Sabina silicicola J.K. Small, J. New York Bot. Gard. 24:5. 1923. (based upon J. barbadensis sensu C. Mohr, U.S.D.A. Bur. Forest. Bull. 31: 37. 1901).

J. barbadensis sensu authors, not Linnaeus.

The juniper of the se. United States coastal plain river swamps was recognized as distinct from J. virginiana (Sargent, 1902, Sylva N.

Amer. 14:89). Distinguishing characters include the slender pendulous branchlets; long, often pendulous branches; broad open crown; smaller female cones ripening in the first growing season; and the more hydric habitat. Recognition as a taxon separate from J. virginiana and from the junipers of the Caribbean islands was made by Small (1923), as Sabina silicicola.

Investigations of the J. virginiana, J. silicicola, and the Caribbean islands junipers are required to determine similarity and whether these junipers are to be referred to different species.

Distribution: On the coastal plain, mostly near the coast line from se. North Carolina, s. to Florida, and w. to se. Texas (Correll and Johnston, 1970). Map: Mohr (1901), plate III, as J. barbadensis; Little (1971), Map 29-E.

20. Juniperus standleyi Steyermark, Field Mus. Nat. Hist., Bot. Ser. 23:3. 1943. Type: Guatemala: San Marcos: Volcan Tacana, Steyermark 36137 (Holotype: F!; Isotype: F!).

Distribution: Volcan Tacana on Mexico-Guatemala border, and Depto. Huehuetenango, Guatemala. Map: Zanoni and Adams (1978). Selected Reference: Standley and Steyermark (1958).

21. Juniperus virginiana L., Sp. Pl. 1039. 1753. Type: (Holotype: LINN); J. foetida  $\eta$  virginiana Spach, Ann. Sci. Nat. ser. 2 16:298. 1841; Sabina virginiana (L.) Antoine, Cupress.-Gatt. 61. 1857.
- J. caroliniana Miller, Dict. ed. 8. 1768; J. virginiana var. 3. caroliniana (Miller) Loudon, Arb. & Frut. Brit. 6:2495. 1838; J. virginiana  $\beta$  caroliniana Willdenow, Berl. Baumz. 157. 1796.
- J. arborescens Moench, Meth. Pl. 699. 1794.
- J. fragrans R. A. Salisbury, Prodromus 397. 1796.
- J. virginiana hermanni Persoon, Synop. Pl. 2:632. 1807; J. hermanni Sprengel, Syst. Veg. 3:908. 1826.
- J. virginiana  $\alpha$  vulgaris Hayne, Dendr. Fl. 205. 1822.
- J. virginiana A vulgaris Endl., Syn. Conif. 28. 1847.
- J. virginiana f. Bremerae Standley and J. F. Macbride, Rhodora 31:193. 1929. Type: United States: Indiana: Porter County: sand dunes, "Stockyards" Addition, near Port Chester, M. Bremer on November 4, 1928 (Holotype: F!).
- J. virginiana var. crebra Fernald & Griscom, Rhodora 37:133.

1935. Type: United States: Massachusetts: Barnstable County: dry, open gravelly soil, Barnstable, Fernald and Long 17797 (Holotype: G); Sabina virginiana var. crebra (Fernald & Griscom) Moldenke, *Phytologia* 2:473. 1948.

J. virginiana var. ambigens Fassett, Bull. Torrey Bot. Club 72:380. 1945. Type: United States: Maine: Lincoln County: Thread-of-Life Ledges on Needles Eye Island, Bristol, Fassett 22125 (Holotype: WIS).

Fassett (1943, 1944a, 1944b, 1945a, 1945b), Van Haverbeke (1968), and Schurtz (1973) examined morphological variation in J. virginiana. Their results showed clinal variation and hybridization with J. horizontalis and J. scopulorum. Hall (1952a, 1952b, 1955; Hall and Carr 1964, 1968) reported hybridization with J. scopulorum and with J. ashei. Studies (Flake, von Rudloff, and Turner, 1969; Flake and Turner, 1973) of the volatile leaf terpenoids of J. virginiana showed clinal variation and did not substantiate the reports of hybridization with J. scopulorum. Further investigations into the nature of geographic variation of J. virginiana, J. scopulorum, and J. horizontalis are required for assessment of the reports of hybridization among these three species.

Taxonomic recognition of possible hybrids and of growth-habit variants do not appear to be useful because of the random, sporadic occurrence of the named varieties.

Distribution: From sw. Maine, w. to w. North Dakota, s. to Texas, e. to n. Florida, U.S.A.; and se. Canada. Map: Little (1971): Maps 31-W, 31-E; Fowells (1965), p. 212. Selected References: Ferguson (1970); Harper (1912); Mohr (1901); Fowells (1965).

#### The Island Junipers

The identity of the various populations of junipers on Antigua, Bahamas, Barbados, Cuba, Dominican Republic, Haiti, and Jamaica has been a case of nomenclatural chaos. Carabia (1941) concluded that the junipers from these islands formed one species after he examined specimens. His review of the nomenclatural history of these junipers resulted in the acceptance of the epithet Juniperus barbadensis L. J. bermudiana L. of Bermuda was accepted as a taxon distinct from J. barbadensis L.

Examination of specimens of the Antillean, Bahaman, and Bermudan junipers at the U.S. National Herbarium (US) has led the present author to conclude that this nomenclatural matter has not been resolved, and can not be resolved by examination of herbarium specimens only. Populational studies using morphological and chemical data would provide useful data for comparison of the junipers involved in this taxonomic problem.



Indeterminable Epithets

Juniperus andina Nuttall, N. Amer. Sylva 3:95. 1849. Type: "On passing a gorge of the Rocky Mountains or Northern Andes, and approaching Lewis's River of the Oregon," Nuttall in 1834 (Holotype: location not known).

Nuttall collected specimens of this taxon on his 1834 trip westward to the Pacific coast with N. J. Wyeth and J. K. Townsend. Pennell (1936) indicated that Nuttall used "Rocky Mountains" to denote the part of the journey through Wyoming and Idaho. The itinerary is not known from the writings of Nuttall, but from Townsend's narrative (Graustein, 1967, McKelvey, 1955). The expedition traveled from Independence, Missouri westward on the Kansas River, along the Platte River, onto the N. Platte to Red Buttes (s. Wyoming) through South Pass, Wyoming, north on the Green River to Fort Hall, along the Boise River to Vale, north to Fort Walla Walla, then finally along the Snake River to Fort Vancouver, Washington.

If Nuttall collected the specimen in Wyoming, the plant is either what is called J. scopulorum or J. osteosperma today. J. virginiana or J. occidentalis may have been collected, if the assumption about the Wyoming/Idaho collection locality is incorrect. A search for the Nuttall type specimen at BM, GH, and PH was unfruitful. Pennell (1936) and subsequent authors state that most of the Nuttall plant collections are held by these herbaria. The Nuttall epithet J. andina would have nomenclatural priority over J. osteosperma or J. scopulorum, if the specimen could be assigned to either taxon. In the absence of the type specimen, but based only upon the Nuttall illustration, Plate CX, of J. andina, it is likely that J. occidentalis is what was collected. I suggest that continued search for the type be made before relegating J. osteosperma to synonymy under J. andina. Nuttall indicated that his J. andina was the same as Pursh's J. excelsa, however, the specimens of Lewis examined by Pursh had blue cones and is assignable to J. scopulorum (see J. scopulorum for discussion). Smith and Thieret (1959) and Stuckey (1968) give additional details concerning Nuttall's work.

Juniperus canadensis Fisch. (listed for Canada by Steudel, 1841. Nom. Bot. ed. 2:835.)

Juniperus dealbata Gordon, Gard. Mag. (1840) 639, 640. 1840;  
Sabina dealbata (Gordon) Antoine, Cupress.-Gatt. 68. 1857.

Gordon (1840) stated that this species was supposed to be from "North-West America." The name had been attributed to Loudon (1838, Encycl. Trees & Shrubs, p. 1090), however Loudon in later editions of his Encyclopedia attributes the name to Gordon.

It is frequently listed as a synonym of J. occidentalis.

Juniperus henryana R. Brown, Gard. Chron, (4 January 1872):8 1873.

Brown stated that this species was described earlier by him; however, the place of publication is not known. It is said to be in British Columbia and vicinity.

Juniperus radicans Raf., New Flora & Bot. N. Amer. 3:95. 1838.

This species was said to be based on a collection by Lewis and Clark in Oregon.

Juniperus sabina var. rupestris Raf., Med. Flora & Bot. U.S. 2:14. 1830.

This taxon was called "Rocky Savin of Canada." It probably is referable to J. horizontalis (or J. scopulorum or J. virginiana). The location was not cited by Rafinesque.

Juniperus tetragona var. oligosperma Engelm., Trans. Acad. Sci. St. Louis 3:591. 1877.

Engelmann (1877) cited specimens that are now attributable to J. monosperma var. gracilis, J. monticola, and J. saltillensis. This epithet is based on a composite description of 3 taxa, and is attributable to no single taxon.

Sabina multivora Goodwin, Amer. Bot. 37:152. 1931.

This epithet may be attributable to J. osteosperma which is found in "Habitat Montana and Wyoming in dry sandstone ledges." Location of type and specimens were not listed.

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